

(PCT Article 18 and Rules 43 and 44)

| Applicant's or agent's file reference  | FOR FURTHER see Notification of  | of Transmittal of International Search Report  |  |  |  |  |
|--|--|--|--|--|--|--|
| M0925/7069W0   | (Form PCT/ISA/220) as well as, where applicable, item 5 below.   |  |  |  |  |  |
| International application No.  | International filing date (day/month/year)   | (Earliest) Priority Date (day/month/year)  |  |  |  |  |
| PCT/US 99/15816  | 13/07/1999   | 13/07/1998   |  |  |  |  |
| Applicant  | <u> </u>   |  |  |  |  |  |
|  |  |  |  |  |  |  |
| MASSACHUSETTS INSTITUTE O  | F TECHNOLOGY et al.  |  |  |  |  |  |
| according to Article 18. A copy is being tra   |  | hority and is transmitted to the applicant   |  |  |  |  |
| This International Search Report consists of a total of sheets.  X It is also accompanied by a copy of each prior art document cited in this report.   |  |  |  |  |  |  |
| Basis of the report  |  |  |  |  |  |  |
| <ul> <li>With regard to the language, the international search was carried out on the basis of the international application in the<br/>language in which it was filed, unless otherwise indicated under this item.</li> </ul> |  |  |  |  |  |  |
| the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).  |  |  |  |  |  |  |
| <ul> <li>b. With regard to any nucleotide an<br/>was carried out on the basis of the</li> </ul>  | nd/or amino acid sequence disclosed in the interest escuence listing:  | nternational application, the international search   |  |  |  |  |
| contained in the internation   | onal application in written form.  |  |  |  |  |  |
| filed together with the inte   | ernational application in computer readable for  | m.   |  |  |  |  |
| furnished subsequently to  | furnished subsequently to this Authority in written form.  |  |  |  |  |  |
|  | this Authority in computer readble form.   |  |  |  |  |  |
| the statement that the sul<br>international application a  | the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished. |  |  |  |  |  |
| the statement that the info<br>furnished   | ormation recorded in computer readable form i  | is identical to the written sequence listing has been                                      |  |  |  |  |
| 2. X Certain claims were fou   | nd unsearchable (See Box I).   |  |  |  |  |  |
| 3. Unity of Invention is lac   | king (see Box II).   |  |  |  |  |  |
| 4. With regard to the title,   |  |  |  |  |  |  |
| l m  | , ,  |  |  |  |  |  |
|  | shed by this Authority to read as follows:   |  |  |  |  |  |
|  |  |  |  |  |  |  |
| 5. With regard to the abstract,  |  |  |  |  |  |  |
| the text has been establis   | ubmitted by the applicant.<br>shed, according to Rule 38.2(b), by this Author<br>e date of mailing of this international search re                                     | rity as it appears in Box III. The applicant may, port, submit comments to this Authority. |  |  |  |  |
| 6. The figure of the <b>drawings</b> to be pub   | lished with the abstract is Figure No.   | 2  |  |  |  |  |
| X as suggested by the appl   | icant.   | None of the figures.   |  |  |  |  |
| because the applicant fai  | led to suggest a figure.   |  |  |  |  |  |
| because this figure better   | characterizes the invention.   |  |  |  |  |  |



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| Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)   |  |  |
|---|--|--|
| This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:  |  |  |
| 1. Claims Nos.: because they relate to subject matter not required to be searched by this Authority, namely:  |  |  |
| 2. X Claims Nos.: not applicable because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:  see FURTHER INFORMATION sheet PCT/ISA/210 |  |  |
| 3. Claims Nos.: because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).   |  |  |
| Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)   |  |  |
| This International Searching Authority found multiple inventions in this international application, as follows:   |  |  |
|   |  |  |
| As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.  |  |  |
| 2. As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.   |  |  |
| 3. As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:   |  |  |
| 4. No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:   |  |  |
| Remark on Protest  The additional search fees were accompanied by the applicant's protest.  No protest accompanied the payment of additional search fees.   |  |  |

## FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box I.2

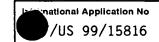
Claims Nos.: not applicable

Present claims 61-63 and 67-75 relate to methods defined by reference to a desirable characteristic or property, namely the products obtained by the methods lack a plane of symmetry.

The claims cover all methods having this characteristic or property, whereas the application provides support within the meaning of Article 6 PCT and/or disclosure within the meaning of Article 5 PCT for only a very limited number of such methods. In the present case, the claims so lack support, and the application so lacks disclosure, that a meaningful search over the whole of the claimed scope is impossible. Independent of the above reasoning, the claims also lack clarity (Article 6 PCT). An attempt is made to define the methods by reference to a result to be achieved. Again, this lack of clarity in the present case is such as to render a meaningful search over the whole of the claimed scope impossible. Consequently, the search has been carried out for those parts of the claims which appear to be clear, supported and disclosed, namely those parts relating to the methods involving enantioselective olefin metathesis reactions.

In view of the extremely broad claims, the search was executed with due regard to the PCT search Guidelines (PCT/GL/2, C-III, paragraph 2.1, 2.3 read in conjunction with 3.7) and Rule 33.3 PCT, i.e. the international search was executed with particular emphasis on the inventive concept, represented by the following subject-matter: enantioselective olefin metathesis reactions, and, insofar as possible and reasonable was complete in that the entire subject-matter to which the claims are directed has been taken into account.





A. CLASSIFICATION OF SUBJECT MATTER IPC 7 C07B53/00 C07B57/00

C07F11/00

C07F7/18

C07D307/28

C07D309/18

According to International Patent Classification (IPC) or to both national classification and IPC

#### B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  $IPC \ 7 \ C07B$ 

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

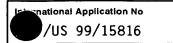
Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

| C. DOCUMENTS CONSIDERED TO BE RELEVANT |   |  |
|--|---|--|
| Category °                             | Citation of document, with indication, where appropriate, of the relevant passages  | Relevant to claim No.                    |
| X                                      | O. FUJIMURA: "Asymmetric ring-closing metathesis catalyzed by chiral molybdenum alkylidene complexes" JOURNAL OF ORGANIC CHEMISTRY, vol. 63, no. 3, 6 February 1998 (1998-02-06), pages 824-832, XP002102158 EASTON US page 826, column 1; page 828, column 2  -/ | 1-7,<br>12-14,<br>34,<br>56-60,<br>74-76 |
|  | <u> </u>  |  |

| X Further documents are listed in the continuation of box C.  | further documents are listed in the continuation of box C.     X   Patent family members are listed in annex.   |  |  |
|---|---|--|--|
| <ul> <li>Special categories of cited documents:</li> <li>"A" document defining the general state of the art which is not considered to be of particular relevance</li> <li>"E" earlier document but published on or after the international filling date</li> <li>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</li> <li>"O" document referring to an oral disclosure, use, exhibition or other means</li> <li>"P" document published prior to the international filling date but later than the priority date claimed</li> </ul> | "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention  "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone  "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.  "&" document member of the same patent family |  |  |
| Date of the actual completion of the international search  5 November 1999  | Date of mailing of the international search report  19/11/1999  |  |  |
| Name and mailing address of the ISA  European Patent Office, P.B. 5818 Patentlaan 2  NL - 2280 HV Rijswijk  Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  Fax: (+31-70) 340-3016  | Authorized officer  Wright, M   |  |  |

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| C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT  |  |  |  |
|---|--|--|--|
| Citation of document, with indication,where appropriate, of the relevant passages   | Relevant to claim No.  |  |  |
| J. B. ALEXANDER: "Catalytic enantioselective ring-closing metathesis by a chiral biphen-Mo complex" JOURNAL OF THE AMERICAN CHEMICAL SOCIETY, vol. 120, no. 16, 29 April 1998 (1998-04-29), pages 4041-4042, XP002102157 DC US the whole document   | 77-79,<br>84-86  |  |  |
| O. FUJIMURA: "Asymmetric ring-closing metathesis: kinetic resolution catalyzed by a chiral molybdenum alkylidene complex" JOURNAL OF THE AMERICAN CHEMICAL SOCIETY, vol. 118, no. 10, 1996, pages 2499-2500, XP002102152 DC US the whole document   | 77-79,84   |  |  |
| L. E. MARTINEZ: "Highly enantioselective ring opening of epoxides catalyzed by (salen)Cr(III) complexes" JOURNAL OF THE AMERICAN CHEMICAL SOCIETY, vol. 117, no. 21, 31 May 1995 (1995-05-31), pages 5897-5898, XP000569876 DC US table 3   | 61,62,<br>67-72  |  |  |
| WO 99 42469 A (MIT)<br>26 August 1999 (1999-08-26)<br>claims; examples  | 77-79,<br>84-86  |  |  |
| D. S. LA: "Mo-catalyzed asymmetric synthesis of dihydrofurans. Catalytic kinetic resolution and enantioselective desymmetrization through ring-closing metathesis"  JOURNAL OF THE AMERICAN CHEMICAL SOCIETY, vol. 120, no. 37, 23 September 1998 (1998-09-23), pages 9720-9721, XP002102156 DC US the whole document | 1-10,<br>15-20,<br>34,<br>40-45,<br>56-65,<br>67-72,<br>74-79,<br>84-86  |  |  |
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|   |  |  |  |
|   | Citation of document, with indication, where appropriate, of the relevant passages  J. B. ALEXANDER: "Catalytic enantioselective ring-closing metathesis by a chiral biphen-Mo complex" JOURNAL OF THE AMERICAN CHEMICAL SOCIETY, vol. 120, no. 16, 29 April 1998 (1998-04-29), pages 4041-4042, XP002102157 DC US the whole document  O. FUJIMURA: "Asymmetric ring-closing metathesis: kinetic resolution catalyzed by a chiral molybdenum alkylidene complex" JOURNAL OF THE AMERICAN CHEMICAL SOCIETY, vol. 118, no. 10, 1996, pages 2499-2500, XP002102152 DC US the whole document  L. E. MARTINEZ: "Highly enantioselective ring opening of epoxides catalyzed by (salen)Cr(III) complexes" JOURNAL OF THE AMERICAN CHEMICAL SOCIETY, vol. 117, no. 21, 31 May 1995 (1995-05-31), pages 5897-5898, XP000569876 DC US table 3  WO 99 42469 A (MIT) 26 August 1999 (1999-08-26) claims; examples  D. S. LA: "Mo-catalyzed asymmetric synthesis of dihydrofurans. Catalytic kinetic resolution and enantioselective desymmetrization through ring-closing metathesis" JOURNAL OF THE AMERICAN CHEMICAL SOCIETY, vol. 120, no. 37, 23 September 1998 (1998-09-23), pages 9720-9721, XP002102156 DC US |  |  |

on on patent family members

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Patent family Publication Patent document Publication cited in search report member(s) date date NONE WO 9942469 Α 26-08-1999